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EXCELLENCE
RED SEAL · SCEAU ROUGE

National Occupational Analysis

# Gasfitter - Class A

2014

CANADIAN STANDARD OF EXCELLENCE FOR SKILLED TRADES

INTERPROVINCIAL STANDARD
CANADA
NORME INTERPROVINCIALE

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Canada

**National Occupational Analysis**

# Gasfitter - Class A

**2014**

| | |
|---|---|
| Trades and Apprenticeship Division | Division des métiers et de l'apprentissage |
| Labour Market Integration Directorate | Direction de l'intégration au marché du travail |
| National Occupational Classification: | 7253 |
| Disponible en français sous le titre : | Monteur/monteuse d'installations au gaz (classe A) |

This publication is available online: www.red-seal.ca

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**PDF**
Cat. No.: Em15-1/1-2014E-PDF
ISBN: 978-1-100-23340-6

# FOREWORD

***The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis (NOA) as the national standard for the occupation of Gasfitter - Class A.***

**Background**

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Employment and Social Development Canada (ESDC) sponsors a program, under the guidance of the CCDA, to develop a series of NOAs.

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

# ACKNOWLEDGEMENTS

The CCDA and ESDC wish to express sincere appreciation for the contribution of the many tradespersons, industrial establishments, professional associations, labour organizations, provincial and territorial government departments and agencies, and all others who contributed to this publication.

Special acknowledgement is extended by ESDC and the CCDA to the following representatives from the trade.

| | |
|---|---|
| Pierre Beaupré | Quebec |
| Frank Boone | Nova Scotia |
| Shawn Carpenter | Prince Edward Island |
| Tim Furlong | Manitoba |
| Chris Henriksen | Saskatchewan |
| Ed Kneller | United Association |
| Shane McCarthy | Ontario |
| Wesley McMyn | British Columbia |
| Joey Molloy | New Brunswick |
| Richard Pickering | Saskatchewan |
| Michael Pizzolato | British Columbia |
| Matt Reid | Prince Edward Island |
| Shane Ryder | New Brunswick |
| Jake Tschetter | Manitoba |
| Ryan Urquhart | Nova Scotia |
| Alan Vanderploeg | Ontario |
| John Wood | United Association |

This analysis was prepared by the Labour Market Integration Directorate of ESDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the NOA development team of the Trades and Apprenticeship Division. The host jurisdiction of Manitoba also participated in the development of this NOA.

**Comments or questions about National Occupational Analyses may be forwarded to:**

Trades and Apprenticeship Division
Labour Market Integration Directorate
Employment and Social Development Canada
140 Promenade du Portage, Phase IV, 5th Floor
Gatineau, Quebec K1A 0J9
Email: redseal-sceaurouge@hrsdc-rhdcc.gc.ca

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To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

| | |
|---|---|
| **Blocks** | the largest division within the analysis that is comprised of a distinct set of trade activities |
| **Tasks** | distinct actions that describe the activities within a block |
| **Sub-Tasks** | distinct actions that describe the activities within a task |
| **Key Competencies** | activities that a person should be able to do in order to be called 'competent' in the trade |

The analysis also provides the following information:

| | |
|---|---|
| **Trends** | changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment |
| **Related Components** | a list of products, items, materials and other elements relevant to the block |
| **Tools and Equipment** | categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A |
| **Context** | information to clarify the intent and meaning of tasks |
| **Required Knowledge** | the elements of knowledge that an individual must acquire to adequately perform a task |

The appendices located at the end of the analysis are described as follows:

| | |
|---|---|
| **Appendix A — Tools and Equipment** | a non-exhaustive list of tools and equipment used in this trade |
| **Appendix B — Glossary** | definitions or explanations of selected technical terms used in the analysis |
| **Appendix C — Acronyms** | a list of acronyms used in the analysis with their full name |
| **Appendix D — Block and Task Weighting** | the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam |
| **Appendix E — Pie Chart** | a graph which depicts the national percentages of exam questions assigned to blocks |
| **Appendix F — Task Profile Chart** | a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis |

# DEVELOPMENT AND VALIDATION OF ANALYSIS

**Development of Analysis**

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from ESDC. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

**Draft Review**

The NOA development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

**Validation and Weighting**

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

| | |
|---|---|
| **BLOCKS** | Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade. |
| **TASKS** | Each jurisdiction assigns a percentage of exam questions to each task within a block. |
| **SUB-TASKS** | Each jurisdiction indicates, with a YES or NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction. |

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

**Definitions for Validation and Weighting**

| | |
|---|---|
| **YES** | sub-task performed by qualified workers in the occupation in a specific jurisdiction |
| **NO** | sub-task not performed by qualified workers in the occupation in a specific jurisdiction |
| **NV** | analysis Not Validated by a province/territory |
| **ND** | trade Not Designated in a province/territory |
| **NOT COMMON CORE (NCC)** | sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade |
| **NATIONAL AVERAGE %** | average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade |

**Provincial/Territorial Abbreviations**

| | |
|---|---|
| **NL** | Newfoundland and Labrador |
| **NS** | Nova Scotia |
| **PE** | Prince Edward Island |
| **NB** | New Brunswick |
| **QC** | Quebec |
| **ON** | Ontario |
| **MB** | Manitoba |
| **SK** | Saskatchewan |
| **AB** | Alberta |
| **BC** | British Columbia |
| **NT** | Northwest Territories |
| **YT** | Yukon Territory |
| **NU** | Nunavut |

# ANALYSIS

Safe working procedures and conditions, accident prevention, and the preservation of health and company assets are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

## SCOPE OF THE GASFITTER-CLASS A

"Gasfitter – Class A" is this trade's official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by gasfitters - class A whose occupational title has been identified by some provinces and territories of Canada under the following names:

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gasfitter | | | | | ✓ | | | | | | | | |
| Gasfitter First Class | | | | | | | | | | | | | ✓ |
| Gasfitter (General) | | | | | | | | ✓ | | | | | |
| Gasfitter Level 1 | | ✓ | | | | | | | | | | | |
| Gasfitter (A) | | | | | | | | | ✓ | | ✓ | | |
| Gasfitter (Class A) | | | | | | | ✓ | | | ✓ | | | |
| Gasfitter (First Class) | | | | | | | | | | | | ✓ | |
| Gas Installer (Class D) | | | ✓ | | | | | | | | | | |
| Gas Technician 1 | | | | ✓ | | ✓ | | | | | | | |

Gasfitters – Class A size, install, test, adjust, maintain and repair lines, appliances, equipment and accessories in various sectors. Gases may include natural gas, manufactured gas, or mixtures of propane gas and air, propane, propylene, butanes (normal butane or isobutane), butylenes and hydrogen. They work on appliances and equipment including those exceeding 400 000 Btuh (British Thermal Units per hour) or 120 kW (kilowatts). Appliances and equipment would include boilers, burners, makeup air units, furnaces, process burners, commercial equipment and various other gas-fired equipment, some of which can be quite complex.

Gasfitters – Class A may work in the residential, manufacturing, and industrial, commercial, and institutional (ICI) sectors. They may be employed by utility companies to repair and extend gas mains, and install, repair and service pipes and fittings between mains and buildings. For mechanical and service companies, they may install and maintain piping and appliances. Gasfitters – Class A may also be employed in the propane industry to install and service propane vaporizers, temporary heating, and propane metering, dispensing and pumping equipment. For safety reasons, the gasfitting trade is regulated across Canada. Regulatory authorities for the trade are the provincial or territorial licensing or certification bodies.

The work environment for gasfitters – class A is varied and may involve working in extreme or adverse conditions. Gasfitters – Class A may work both indoors and outdoors. They may work in confined spaces, at heights, and around heavy equipment and piping systems. Gasfitters –

Class A may respond to emergencies at any time. There are some hazards involved in working with electricity, flammable gases and power tools. Work conditions may be stressful as gasfitters - class A may need to respond to emergency hazardous situations.

Gasfitters – Class A require manual dexterity and upper and lower limb coordination to operate power tools in cramped conditions and to climb ladders. Good physical condition is important because the work often requires considerable standing, lifting and moving of heavy items. They are also required to crouch, bend, kneel, crawl and twist when moving around equipment and piping systems.

Strong mechanical aptitudes, problem solving skills and a good understanding of electrical/electronic and combustion theory are essential for working in this trade. In addition, there is a requirement for strong mathematical, spatial visualization and communication skills. Gasfitters - Class A must be able to interpret drawings and technical manuals.

This analysis recognizes similarities or overlaps with the work of other trades such as gasfitters – class B, plumbers, steamfitters/pipefitters, oil heat system technicians, welders, refrigeration and air conditioning mechanics, electricians, sheet metal workers and instrumentation and control technicians. Experienced gasfitters – class A often act as mentors and coaches to apprentices in the trade. Career advancement opportunities may include supervisory positions such as supervisor, maintenance manager or service manager, starting their own contracting business or becoming trainers.

## OCCUPATIONAL OBSERVATIONS

Gasfitters require more computer and digital skills to work in this trade. More computers and laptops are now used to perform diagnostics and setup of systems. Increasingly, building automation systems incorporate the environmental control systems. Mobile and wireless communication are used to communicate with clients, and gather technical information for the trade.

The type, use and accuracy of analyzers have increased. There is also an increase in use, type and quality of electronic tools such as signal generators and network communication tools.

There are more plastics and stainless steels used in piping and tubing and equipment. These are used for increased durability and longevity. Gasfitters adapt their work practices, tools and equipment to work with these new materials.

Quality control (QC) and quality assurance (QA) practices have increased significantly. Gasfitters now spend more of their time documenting work performed, materials used, and processes used for testing. They must stay up-to-date and aware of the QC and QA requirements in the jurisdiction where they work.

Safety procedures and practices have become more and more stringent. There are additional requirements for performing hazard assessments, using personal protective equipment (PPE) and attending safety meetings. Gasfitters must maintain ongoing safety training in a number of areas, including Transport of Dangerous Goods (TDG), confined space, hazardous energy isolation, mobile equipment and fall protection.

There is a trend towards green building certification such as Leadership in Energy and Environmental Design (LEED) certification resulting in tighter "building as a system" requirements which facilitate better energy conservation and healthier building environments. Gasfitters must consider these requirement in the workplace and when installing, servicing and verifying the final operation of systems.

## ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change. Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

Tools are available online or for order at: http://www.hrsdc.gc.ca/eng/jobs/les/index.shtml .

The essential skills profile for the gasfitter trade indicates that the most important essential skills are **document use, oral communication** and **decision making**.

The application of these skills may be described throughout this document within the competency statements which support each subtask of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

***Reading***
Gasfitters read descriptions and explanations on work orders and memos from supervisors and clients on details of the work tasks and activities that need to be done. They read warnings and instructions on labels, signs, tags and placards to make decisions about special precautions or procedures that are needed for a particular job. They must interpret code specifications and requirements to determine if equipment or system installations meet code requirements.

***Document Use***
Gasfitters use manufacturers' specification sheets, equipment manuals and code books to locate technical information and operation settings in order to complete maintenance and repair procedures. They refer to drawings, pictures and diagrams in equipment manuals in order to troubleshoot equipment problems and complete repair and replacement procedures. Gasfitters use and read schematic drawings to understand various systems such as equipment, control, electrical, gas supply and energy distribution systems.

***Writing***
Gasfitters write detailed notes in logbooks, notebooks, layout drawings and inspection checklists to keep records of equipment installation, changes and deficiencies. They provide descriptive texts on work orders to provide description of work performed, equipment

deficiencies and required remedial actions. Gasfitters create as-built diagrams and sketches. Gasfitters may complete sections of incident or accident reports.

***Numeracy***

Gasfitters calculate materials needed and determine estimates for installation or service jobs. Gasfitters convert length and volume measurement from metric to imperial units and vice versa. They also perform calculations for venting, combustion air and gas pipe sizing requirements. They take measurements such as distance, volume, temperature and pressure. These calculations and measurements are used for such things as sizing combustion air, energy distribution and exhaust gas analysis.

***Oral Communication***

Gasfitters communicate with customers, managers, supervisors, co-workers and other trades to discuss equipment problems and outline job requirements, legal implications and negotiate repair processes. They also follow up with customers after jobs are completed to explain equipment operation and answer questions. Gasfitters may also communicate with a range of officials, such as inspectors and engineers.

***Thinking Skills***

Gasfitters problem solve when facing unexpected installation, service and removal problems. They may decide to not enter homes or buildings where personal health and safety may be at risk. Based on their sensory inspections, their knowledge of instrumentation, controls and equipment performance and the urgency to restart systems, gasfitters determine how to troubleshoot, maintain or replace equipment or components. They may also decide how and where to install system components to meet manufacturers' specifications, code requirements and maintain efficiency. Gasfitters evaluate efficiency of gas-fired systems. They also plan and organize their daily tasks.

***Working with Others***

Gasfitters may work alone or with a team depending on the task requirements. When working with others, they may coordinate with other trades and contractors. They mentor and train apprentices and co-workers on the job.

***Computer Use***

Gasfitters use computer programs to create installation layouts or to troubleshoot system or equipment problems. They use computers to interface with equipment and programming, changing parameters and maintaining control systems. They use electronic communication to communicate with customers, coworkers, suppliers or subcontractors.

***Continuous Learning***

Gasfitters often have in-house training or attend seminars to update their required site-specific and safety certifications such as WHMIS, fall arrest training, first aid and many others. Gasfitters must become proficient with new equipment, technology, regulations, codes and procedures by attending training sessions and seminars, reading manuals and through on-the-job experience.

**Trends**

Safety requirements are becoming more stringent.

There are more electronic-based tools and equipment. There is an increase in the use of digitally based documentation and communication.

Disposal and recycling methods are becoming more important due to environmental concerns and LEED requirements.

**Related Components**

All components apply.

**Tools and Equipment**

See Appendix A.

## Task 1 Performs safety-related functions.

**Context**

Gasfitters must be able to recognize hazards and protect themselves, others, property and the environment when working with gas systems and equipment.

**Required Knowledge**

| | |
|---|---|
| K 1 | types of PPE such as safety glasses, gloves, face shields, hearing protection, respiratory equipment, safety footwear and hard hats |
| K 2 | types of safety equipment such as fall arrest devices, first aid kits and eye wash stations |
| K 3 | limitations of PPE and safety equipment |
| K 4 | PPE and safety equipment operations |
| K 5 | client and company safety policies |
| K 6 | disposal and recycling procedures |
| K 7 | emergency procedures and location of on-site first aid stations and equipment |
| K 8 | jurisdictional health and safety acts and regulations |
| K 9 | training requirements such as fall protection and confined space entry |
| K 10 | clear path for access to and egress from confined spaces |
| K 11 | workers' rights and responsibilities |

| | |
|---|---|
| K 12 | fire safety and hot work permit procedures |
| K 13 | housekeeping practices |
| K 14 | WHMIS |
| K 15 | locations of WHMIS manuals and material safety data sheets (MSDS) |
| K 16 | lock-out, tag-out and zero energy procedures (individual or group) |
| K 17 | environmental protection procedures |
| K 18 | spill kits |
| K 19 | due diligence |
| K 20 | stored energy potential (thermal, electric, kinetic, radiation) |
| K 21 | job safety analysis |
| K 22 | safety training |
| K 23 | site specific training requirements |
| K 24 | authority having jurisdiction (AHJ) |

---

**Sub-task**

**A-1.01 Uses personal protective equipment (PPE) and safety equipment.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-1.01.01 | select PPE and safety equipment specific to job task |
| A-1.01.02 | organize PPE and safety equipment according to company policies and OH&S regulations |
| A-1.01.03 | clean and store PPE and safety equipment according to manufacturers' recommendations |
| A-1.01.04 | recognize worn, damaged or defective PPE and safety equipment, and remove from service |
| A-1.01.05 | ensure proper fit of PPE and safety equipment |

**Sub-task**

**A-1.02 Maintains safe work environment.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-1.02.01 | recognize and address hazards such as poor housekeeping that could cause personal injury, or equipment or environmental damage |
| A-1.02.02 | handle and store hazardous materials according to WHMIS |
| A-1.02.03 | install safety protection such as signage, barrier tape and barricades |
| A-1.02.04 | identify and implement adequate ventilation in workspace |
| A-1.02.05 | ensure clear path of access to and egress from confined spaces |
| A-1.02.06 | test air quality of confined spaces on a continuous basis using hand held devices |
| A-1.02.07 | follow confined space procedures and regulations |
| A-1.02.08 | ensure cables and straps do not get caught in rotating equipment |
| A-1.02.09 | follow lock-out and tag-out procedures to isolate hazardous energies such as electricity, steam and fuel sources |
| A-1.02.10 | follow elevated height procedures and requirements |
| A-1.02.11 | perform air analysis to ensure air quality and identify dangerous air substances such as CO, $H_2S$ and radon |
| A-1.02.12 | protect surrounding area when using torches or open flame |

## Task 2 Maintains and uses tools and equipment.

**Context** Gasfitters need to use and maintain tools and equipment in order to perform their daily tasks safely and efficiently.

**Required Knowledge**

| | |
|---|---|
| K 1 | gas properties such as limits of flammability, flame speed, ignition temperature and density |
| K 2 | principles and concepts of electronics and electricity |
| K 3 | principles and concepts of chemistry and physics |
| K 4 | manufacturers' specifications |
| K 5 | types of technical instruments and testers |

| | |
|---|---|
| K 6 | types of tools such as hand, power and powder-actuated |
| K 7 | company policies and procedures |
| K 8 | lock-out and tag-out procedures |
| K 9 | safe operating procedures for power and powder-actuated tools |
| K 10 | licensing and training requirements for the use of powder-actuated tools and power elevated work platforms |
| K 11 | types of fasteners |
| K 12 | safety precautions, hazards, risks and safe work procedures |
| K 13 | types of lifting, rigging and hoisting equipment |
| K 14 | training requirements for lifting, rigging and hoisting equipment |
| K 15 | components of lifting, rigging and hoisting equipment |
| K 16 | hand signals for lifting, rigging and hoisting |
| K 17 | rigging and hoisting practices such as load weight calculations, working load limits and sling angles |
| K 18 | knots and hitches |
| K 19 | basic welding, brazing and soldering equipment |
| K 20 | interpretation of testing results |
| K 21 | operating procedures such as arc flash protection |
| K 22 | safe testing procedures for AC/DC voltages |
| K 23 | inspection procedures |
| K 24 | AHJ |

---

**Sub-task**

**A-2.01 Maintains hand, power and powder-actuated tools.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-2.01.01 | clean and lubricate hand, power and powder-actuated tools according to manufacturers' recommendations |
| A-2.01.02 | recognize worn, damaged or defective tools, and remove from service |
| A-2.01.03 | store tools according to manufacturers' recommendations |

**Sub-task**

**A-2.02 Uses technical instruments and testers.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-2.02.01 | select technical instruments and testers for specific tasks |
| A-2.02.02 | interpret results provided by technical instruments and testers |
| A-2.02.03 | calibrate technical instruments and testers according to manufacturers' specifications |
| A-2.02.04 | measure AC/DC circuit and resistance according to specific task and equipment requirements with instruments such as multimeters and megohmmeters |
| A-2.02.05 | perform pressure tests using instruments such as manometers, and differential pressure and pressure gauges |
| A-2.02.06 | perform tests and analysis such as gas analysis, indoor air quality test, combustion analysis and hazardous leak test, according to job requirements |
| A-2.02.07 | identify unsafe, worn, damaged or defective technical instruments and testers, and remove from service |
| A-2.02.08 | inspect technical instruments and testers before each use to ensure accuracy and safety |
| A-2.02.09 | store technical instruments and testers according to manufacturers' specifications |

**Sub-task**

**A-2.03 Uses access equipment.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-2.03.01 | select access equipment taking into consideration unstable conditions such as soft and uneven ground, and job requirements |
| A-2.03.02 | set up and operate access equipment according to OH&S regulations and company policies |
| A-2.03.03 | identify unsafe, worn, damaged or defective access equipment, and remove from service |

| | |
|---|---|
| A-2.03.04 | clean and maintain access equipment according to manufacturers' specifications |
| A-2.03.05 | dismantle and store access equipment according to manufacturers' specifications |

---

**Sub-task**

**A-2.04 Operates lifting, rigging and hoisting equipment.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-2.04.01 | select and tie knots according to load and application |
| A-2.04.02 | select lifting and rigging equipment such as spreader beams, slings and chokers, according to load and application |
| A-2.04.03 | set up load to enable access for lifting chains and slings |
| A-2.04.04 | locate lifting points to ensure proper sling angle and to balance and secure the load |
| A-2.04.05 | secure load using rigging methods such as choking, slinging and securing hooks, according to manufacturers' specifications and safety procedures |
| A-2.04.06 | use rigging and tag lines to guide and control the load |
| A-2.04.07 | follow daily procedures such as inspection of rigging equipment and storage |
| A-2.04.08 | use approved hand signals |
| A-2.04.09 | maintain and store lifting, rigging and hoisting equipment in designated area |

## Task 3 Plans and prepares for installation, service and maintenance.

**Context**

Gasfitters plan and prepare for installation, service and maintenance by using and interpreting drawings, specifications and codes. They may also prepare drawings and provide specifications for installation. They select systems and their components according to the job requirements. In organizing their work, gasfitters lay out gas-fired equipment and systems, and check for the availability of equipment. They also ensure that all documentation is in order. Gasfitters work with other trades to ensure timely and safe completion of site work.

**Required Knowledge**

| | |
|---|---|
| K 1 | codes such as Natural Gas and Propane Installation Code (B149), Canadian Electrical Code (CEC), National Building Code (NBC) |
| K 2 | safety requirements such as OH&S and WHMIS |
| K 3 | electrical, electronic and mechanical drawings, including schematics, isometrics, wiring diagrams, layouts, interconnections, elevations, block and single lines |
| K 4 | conventionally accepted symbols, abbreviations, National Electrical Manufacturers Association (NEMA) numbers |
| K 5 | electrical terminology |
| K 6 | standards such as American National Standards Institute (ANSI), Canadian Standards Association (CSA) and Underwriters Laboratories of Canada (ULC) |
| K 7 | heat loss calculations |
| K 8 | types of gas-fired equipment and components |
| K 9 | hangers and supports |
| K 10 | gas pressure requirements |
| K 11 | venting system combinations and category of appliances I, II, III and IV |
| K 12 | additional requirements for equipment such as process ovens, baking ovens, process furnaces, and atmosphere generators |
| K 13 | altitude elevation rated equipment |
| K 14 | certification requirements |
| K 15 | components and their symbols on valve trains (main and pilot) |
| K 16 | regulator applications, clearances, sizing and their accessories |
| K 17 | types of fans, auxiliary fans, and dampers and interlocks for equipment such as furnaces and ovens |
| K 18 | sizing charts and calculations |

| | |
|---|---|
| K 19 | gas properties such as limits of flammability, flame speed, ignition temperature and density |
| K 20 | principles and concepts of electronics and electricity |
| K 21 | principles and concepts of chemistry and physics |
| K 22 | manufacturers' specifications |
| K 23 | acts, regulations, standards and AHJ |

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**Sub-task**

**A-3.01 Interprets drawings and codes.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-3.01.01 | select drawings, specifications and codes according to job requirements |
| A-3.01.02 | review drawings and specifications for inconsistencies and accuracy |
| A-3.01.03 | select and use tools such as scaled rulers, calculators and charts |
| A-3.01.04 | measure lengths and dimensions of equipment and pipe to ensure consistency with job site |
| A-3.01.05 | calculate material requirements such as fittings, hangers and supports according to drawings, specifications and codes |
| A-3.01.06 | identify orientation of equipment and pipes to determine installation location and to avoid conflicts with other objects |
| A-3.01.07 | create isometric drawings using plans and drawings to assist in determining material requirements and layout |
| A-3.01.08 | use codes to determine minimum amount and type of material according to drawings and specifications |
| A-3.01.09 | use codes to confirm and calculate minimum service clearances, access requirements and allowances |
| A-3.01.10 | prepare schematic diagrams from plans and drawings using standard formats, symbols and reference systems |
| A-3.01.11 | trace electrical processes through schematics and block diagrams to determine control device requirements using specifications and codes |
| A-3.01.12 | cross-reference all types of plans and drawings to each other to ensure accuracy |

**Sub-task**

**A-3.02 Selects systems, equipment and components.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-3.02.01 | identify and choose systems, equipment, venting and components requirements according to system capacity, site conditions, AHJ and codes |
| A-3.02.02 | interpret and apply heat loss calculations for job requirements |
| A-3.02.03 | size systems such as gas-fired appliances, fuel-gas piping, venting, air supply and controls based on appliance input, according to codes, AHJ, and job and manufacturers' specifications |
| A-3.02.04 | determine on-site availability and capacity of drainage, fuel, electrical and control compatibility to compare with equipment requirements |

**Sub-task**

**A-3.03 Organizes work.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| A-3.03.01 | determine labour requirements according to size and scope of work |
| A-3.03.02 | acquire permits according to site requirements, AHJ and codes |
| A-3.03.03 | select tools and equipment and ensure availability, according to job requirements |
| A-3.03.04 | coordinate work schedules with other trades, customers and inspectors according to job requirements |
| A-3.03.05 | acquire and distribute documentation such as plans, drawings, equipment specifications and safety procedures according to job requirements |
| A-3.03.06 | coordinate logistics of transportation and placement of equipment, material and labour to job site |
| A-3.03.07 | create bill of material according to drawings, codes and specifications |
| A-3.03.08 | order and acquire materials according to job requirements |
| A-3.03.09 | coordinate job site documentation such as daily logs, time sheet and as-built final drawings |

## BLOCK B GAS PIPING PREPARATION AND ASSEMBLY

**Trends**

There is an increase in use of Corrugated Stainless Steel Tubing (CSST) in piping due to ease of installation.

**Related Components (include, but not limited to)**

**Pipes:** plastic pipe, steel pipe

**Fittings:** riser, tee, coupling, 90°, 45°, flanges, unions, flare nuts

**Tube and tubing:** copper, stainless, aluminum

Lubrication, joining compounds.

**Tools and Equipment**

See Appendix A.

### Task 4 Fits tube and tubing for gas piping systems.

**Context**

Gasfitters prepare (fabricate) tube and tubing for proper installation and trouble-free operation. Preparation of tube and tubing includes inspection, cutting, bending, joining, supporting and protection. The fabrication of gas piping systems may be done on or off site.

**Required Knowledge**

| | |
|---|---|
| K 1 | thermal coefficient of expansion |
| K 2 | AHJ |
| K 3 | Natural Gas & Propane Installation Code (B149.1), Propane Storage and Handling Code (B149.2), and code for the Field Approval of Fuel-related Components on Appliances and Equipment (B149.3) |
| K 4 | piping identification |
| K 5 | tube material such as copper, aluminum and stainless steel |
| K 6 | tubing material such as copper, aluminum and corrugated stainless steel |
| K 7 | types and sizes of copper tube such as K, L, and G |
| K 8 | wall thickness of stainless tube and tubing |
| K 9 | standard measuring procedures such as center-to-center, end-to-center, end-to-end, gain or loss and measuring of angles |
| K 10 | common angles such as 90° and 45° |
| K 11 | metric and imperial systems of measurement and conversions |
| K 12 | trade math concepts such as Pythagorean theorem and algebra |

| | |
|---|---|
| K 13 | restrictions on bending of tube and tubing |
| K 14 | joining methods such as brazing, flaring and using compression fittings |
| K 15 | types of joints such as flared, compression and brazed |
| K 16 | types of gaskets, fittings and lubricants |
| K 17 | tube and tubing contents such as natural gas and propane |
| K 18 | types of fluxes for brazing copper tube and tubing |
| K 19 | methods of preventing electrolysis |

---

**Sub-task**

**B-4.01 Prepares tube and tubing for fitting.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| B-4.01.01 | select tube and tubing according to job specifications, codes and AHJ |
| B-4.01.02 | inspect tube and tubing for deficiencies such as impurities, dents and cracks |
| B-4.01.03 | calculate offset and rolling offset dimensions according to spool sheets, drawings and site conditions |
| B-4.01.04 | measure tube and tubing to dimensions according to spool sheets, drawings and site conditions considering fitting, bend and flare allowances |
| B-4.01.05 | mark tube and tubing using tools such as soap stone and markers |
| B-4.01.06 | select tools and equipment such as tube and tubing cutters and reamers according to the type of the tube and tubing |
| B-4.01.07 | cut tube and tubing to length |
| B-4.01.08 | ream tube and tubing to remove burrs from ends |
| B-4.01.09 | seal ends until tube and tubing is installed to prevent contamination using material such as caps and plugs |
| B-4.01.10 | label section of tube and tubing according to job specifications, codes and AHJ |

**Sub-task**

**B-4.02** **Bends tube and tubing for gas piping systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| B-4.02.01 | select tube bender such as ratchets and cranks according to size and material being bent |
| B-4.02.02 | measure and mark bend points according to spool sheets, drawings and site conditions |
| B-4.02.03 | place tube and tubing in benders and bend to match determined dimensions and angles |

**Sub-task**

**B-4.03** **Connects tube and tubing for gas piping systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| B-4.03.01 | identify style of joint such as brazed, flared and compression according to manufacturers' specifications, codes and AHJ |
| B-4.03.02 | select fittings such as 90°, 45°, tee and coupling according to material and joining practice, codes and AHJ |
| B-4.03.03 | clean tube, tubing and fittings to remove impurities such as oxidation and dirt |
| B-4.03.04 | assemble the fittings on the tube and tubing according to manufacturers' specifications |
| B-4.03.05 | select tools, equipment and material such as torch, flux and brazing rod, and flaring tools according to material and joining practice, manufacturers' specifications, codes and AHJ |
| B-4.03.06 | join tube and tubing using methods such as brazing and flaring |
| B-4.03.07 | provide protection and support of tube and tubing according to specifications and codes |

## Task 5 — Fits plastic pipe for gas piping systems.

**Context**

Gasfitters prepare plastic pipe for proper installation and trouble-free operation. Fitting of plastic pipe includes inspection, cutting, joining, supporting and protection according to codes and manufacturers' specifications. The fabrication of gas piping systems may be done on or off site.

**Required Knowledge**

| | |
|---|---|
| K 1 | grades and composition of plastic pipe |
| K 2 | standard measuring procedures such as center-to-center, end-to-center, and end-to-end |
| K 3 | metric and imperial systems of measurement and conversions |
| K 4 | thermal coefficient of expansion |
| K 5 | AHJ |
| K 6 | Natural Gas & Propane Installation Code (B149) |
| K 7 | manufacturers' specifications |
| K 8 | piping identification |
| K 9 | restrictions on use of plastic pipe |
| K 10 | joining methods such as heat fusion and mechanical |
| K 11 | types of fittings and lubricants |
| K 12 | plastic pipe contents such as natural gas and propane |
| K 13 | methods of pipe tracing |
| K 14 | hazards of cutting plastic pipe such as dust and exposed fibres |

**Sub-task**

**B-5.01 Prepares plastic pipe for fitting.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| B-5.01.01 | select plastic pipe according to jurisdictional codes |
| B-5.01.02 | inspect plastic pipe for deficiencies such as impurities, dents and cracks |
| B-5.01.03 | calculate plastic pipe length and fitting allowances |
| B-5.01.04 | calculate dimensions according to spool sheets, drawings and site conditions |

| | |
|---|---|
| B-5.01.05 | measure and mark plastic pipe to length according to spool sheets, drawings and site conditions considering fitting allowances |
| B-5.01.06 | select tools and equipment such as plastic pipe cutters, reamers and chamfering tools |
| B-5.01.07 | cut plastic pipe to length according to job requirements |
| B-5.01.08 | ream plastic pipe to remove burrs from the ends |
| B-5.01.09 | chamfer ends according to size and manufacturers' specifications of plastic pipe |
| B-5.01.10 | label section of plastic pipe according to job specifications, codes and AHJ |

---

**Sub-task**

**B-5.02 Connects plastic pipe for gas piping systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| B-5.02.01 | identify style of joint such as heat fusion, electrofusion and mechanical according to manufacturers' specifications, codes and AHJ |
| B-5.02.02 | select fittings such as risers, tees and couplings according site conditions |
| B-5.02.03 | clean plastic pipe and fittings for joining methods to remove contaminants such as dirt and oil |
| B-5.02.04 | select tools and equipment such as heat fusion machine and electrofusion machine according to manufacturers' specifications, codes and AHJ |
| B-5.02.05 | join plastic pipe by means such as fusion or insert type fitting |
| B-5.02.06 | provide protection and support of plastic pipe according to specifications and codes |

## Task 6 — Fits steel pipe for gas piping systems.

**Context**

Gasfitters prepare steel pipe for proper installation and trouble-free operation. Fitting of steel pipe includes inspection, cutting, joining, supporting and protection according to codes and manufacturers' specifications. The fabrication of gas piping systems may be done on or off site.

**Required Knowledge**

| | |
|---|---|
| K 1 | types, sizes, weights and schedules of steel pipe such as stainless, seamless and galvanized |
| K 2 | manufacturers' specifications |
| K 3 | Natural Gas & Propane Installation Code (B149) |
| K 4 | AHJ |
| K 5 | standards and regulations such as ANSI/American Society of Mechanical Engineers (ASME) |
| K 6 | sequence of bolt tensioning |
| K 7 | types of fittings and lubricants |
| K 8 | standard measuring procedures such as center-to-center, end-to-center, and end-to-end |
| K 9 | piping identification |
| K 10 | metric and imperial systems of measurement and conversions |
| K 11 | trade math concepts such as Pythagorean theorem and algebra |
| K 12 | joining methods such as threading, welding and flanging |
| K 13 | thermal coefficient of expansion |
| K 14 | hangers and support for joints |
| K 15 | types of gaskets, fittings and lubricants |
| K 16 | methods of preventing electrolysis |

**Sub-task**

**B-6.01 Prepares steel pipe for fitting.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| B-6.01.01 | select steel pipe according to job specifications, codes and AHJ |
| B-6.01.02 | inspect steel pipe for deficiencies such as defects, dents and cracks |
| B-6.01.03 | calculate offset and rolling offset dimensions according to spool sheets, drawings and site conditions |
| B-6.01.04 | measure steel pipe to dimensions according to spool sheets, drawings and site conditions considering fitting allowances |
| B-6.01.05 | mark steel pipe using tools such as soap stone, markers and pencils |
| B-6.01.06 | select cutting tools and equipment such as a pipe cutters, grinders and chopsaws, according to size of the pipe |
| B-6.01.07 | select tools and equipment such as reamers, grinders and files according to type of steel pipe to remove defects such as burrs and scales from ends |
| B-6.01.08 | cut steel pipe to length |
| B-6.01.09 | bevel, square and clean pipe end for joining according to AHJ and code requirements |
| B-6.01.10 | seal ends until steel pipe is installed to prevent contamination using material such as caps and plugs |
| B-6.01.11 | label section of steel pipe according to job specifications, codes and AHJ |

**Sub-task**

**B-6.02 Connects steel pipe for gas piping systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| B-6.02.01 | select steel pipe according to job specifications, codes and AHJ |
| B-6.02.02 | identify style of joint such as threaded, welded, flanged and approved mechanical compression fittings according to manufacturers' specifications, codes and AHJ |
| B-6.02.03 | select fittings such as 90°, 45°, tees and couplings according to material and joining practices, codes and AHJ |

| | |
|---|---|
| B-6.02.04 | clean steel pipe and fittings for joining methods such as threaded, welded, and flanged to remove impurities such as oil and dirt |
| B-6.02.05 | select tools and equipment such as hand and power dies according to joining practices, manufacturers' specifications, codes and AHJ |
| B-6.02.06 | select joining compounds such as pipe dope and thread sealant tape according to manufacturers' specifications, codes and AHJ |
| B-6.02.07 | join steel pipe and fittings by machine or hand according to AHJ, codes and national piping practices |
| B-6.02.08 | follow specified sequence of bolt tensioning and torquing |
| B-6.02.09 | provide protection and support of steel pipe according to specifications and codes |

## BLOCK C VENTING AND AIR SUPPLY SYSTEMS

**Trends**

Venting systems are changing due to the use of more energy efficient condensing appliances in more applications. As such, venting materials are becoming more diversified. There is an increase in the use of plastic venting and specialty materials such as stainless steel, polypropylene, polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC).

With the increase of environmental concerns and to have a healthy occupied space, "building as a system" is being widely adopted to help reduce energy consumption and to meet green building requirements. New building construction designs require better air supply systems and conditioned air supply systems for energy efficiency.

**Related Components (include, but not limited to)**

**Venting:** fittings, flashings, pipes, sleeves, fasteners, connectors, fire stops, sealants, adhesives, chimney

**Air supply systems:** fittings, pipes, fasteners, turning vanes, terminations, grilles, louvres

**Draft control systems:** fans, blowers, blades, motors, pressure switches, dampers, gauges, flow indicators, recorders.

**Tools and Equipment**

See Appendix A.

### Task 7 Installs venting.

**Context**

Gasfitters install venting to convey potential hazardous flue gases to a safe location.

**Required Knowledge**

| | |
|---|---|
| K 1 | venting system combinations and category of appliances I, II, III and IV |
| K 2 | types of venting material such as plastic, stainless steel, copper, aluminum, galvanized steel and masonry |
| K 3 | composition and weight of venting materials |
| K 4 | acts, regulations, standards and AHJ |
| K 5 | company policies and procedures |
| K 6 | roles and responsibilities when multiple trades are involved in the work |
| K 7 | standard measuring procedures such as center-to-center, end-to-center, and end-to-end |

| | |
|---|---|
| K 8 | metric and imperial systems of measurement and conversions |
| K 9 | procedures for assembling venting |
| K 10 | mechanical components and accessories such as locking bands and mechanical connections |
| K 11 | manufacturers' specifications |
| K 12 | hazards of cutting and joining vents |
| K 13 | stack, draft and chimney effects |
| K 14 | venting considerations such as condensation, draining, grade, flue gas velocity, and material clearances for natural and mechanical draft |
| K 15 | codes such as National Gas and Propane Installation Code (B149), CEC and NBC |
| K 16 | hazards such as those associated with CO and $CO_2$ concentrations |
| K 17 | heat recovery systems and scrubbers |

---

**Sub-task**

**C-7.01 Lays out venting.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| C-7.01.01 | select and use tools and equipment such as laser levels, measuring tapes, chalk lines and drills |
| C-7.01.02 | determine location of venting lines, terminations and condensation drain traps according to drawings, codes, specifications and best practices, and considering the structure without having an effect on the integrity of the structure. |
| C-7.01.03 | select supporting material such as hangers, brackets and braces according to job and manufacturers' specifications |
| C-7.01.04 | select venting material according to codes and manufacturers' specifications |
| C-7.01.05 | measure, locate and mark distances of support material according to codes and manufacturers' specifications |
| C-7.01.06 | position support material according to codes, clearance requirements and manufacturers' specifications |
| C-7.01.07 | fasten support material to structure using fasteners such as bolts, anchors, straps and screws |

**Sub-task**

**C-7.02 Prepares venting material for assembly.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| C-7.02.01 | select and use tools and equipment such as hacksaws, chopsaws, plastic pipe cutters and tin snips |
| C-7.02.02 | measure section length according to venting termination location |
| C-7.02.03 | calculate venting material length and fitting allowances according to system requirements and manufacturers' specifications |
| C-7.02.04 | cut venting material to length according to calculations |

**Sub-task**

**C-7.03 Connects material for venting.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| C-7.03.01 | select and use tools and equipment such as drills, wrenches, torches and fusion devices |
| C-7.03.02 | prepare material for joining using methods such as cleaning, crimping and priming, according to manufacturers' specifications |
| C-7.03.03 | connect components using methods such as cementing, brazing and welding |
| C-7.03.04 | thread components according to manufacturers' specifications |
| C-7.03.05 | mechanically join components such as a- and b- vents and single wall vents according to manufacturers' specifications and codes |
| C-7.03.06 | fit components such as fittings and terminations according manufacturers' specifications and codes |
| C-7.03.07 | mount and secure venting on supports |
| C-7.03.08 | connect venting to appliance vent connector according to manufacturers' specifications |
| C-7.03.09 | perform pressure test prior to connecting material to ensure system integrity according to AHJ |

## Task 8 — Installs air supply system.

**Context** — Gasfitters install air supply systems to maintain safe and efficient operation of gas appliances. In this task, air supply systems include combustion, dilution and ventilation air in a building as a system.

**Required Knowledge**

| | |
|---|---|
| K 1 | combustion, dilution, ventilation and relief air requirements and applications |
| K 2 | types of air supply systems such as direct and indirect |
| K 3 | types of air supply materials such as plastic, stainless steel, galvanized steel and specialty materials |
| K 4 | sizing charts and calculations of combustion, dilution and ventilation air |
| K 5 | grille sizing allowances |
| K 6 | calculations for conditions such as free area termination, air volume and material weight |
| K 7 | support limitations and load carrying requirements |
| K 8 | National Gas and Propane Installation Code (B149), applicable codes and AHJ |
| K 9 | manufacturers' specifications |
| K 10 | metric and imperial systems of measurement and conversions |
| K 11 | air quality characteristics |
| K 12 | psychrometric characteristics and charts |
| K 13 | category appliance types such as I, II, III and IV |
| K 14 | heat recovery systems and combustion air heaters |

**Sub-task**

**C-8.01** **Lays out air supply system.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| C-8.01.01 | select and use hand and power tools such as drills and measuring tapes |
| C-8.01.02 | determine location of air supply systems, intakes and terminations according to drawings, codes, specifications and best practices |
| C-8.01.03 | select air supply material according to system type, job specifications and codes |

| | |
|---|---|
| C-8.01.04 | select supporting material such as hangers, brackets and braces according to job requirements |
| C-8.01.05 | measure, identify and mark location of air supply system according to codes |
| C-8.01.06 | position air supply systems according to codes and clearance requirements |
| C-8.01.07 | fasten support material to structure using fasteners such as bolts, anchors, straps and screws |

---

**Sub-task**

**C-8.02 Connects air supply systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| C-8.02.01 | select and use tools and equipment such as rigging equipment, power tools and hand tools |
| C-8.02.02 | assemble air supply systems using mechanical fastening components such as s-cleats, drive cleats, bolts and screws, according to layout and drawings, and AHJ |
| C-8.02.03 | mount and secure air supply systems manually or mechanically in support material according to drawings and layout |
| C-8.02.04 | seal joint connections using sealants or mechanical joints to prevent leakage according to codes and manufacturers' specifications |
| C-8.02.05 | fasten air supply systems to appliances according to codes |
| C-8.02.06 | terminate air supply systems according to codes and manufacturers' specifications |

## Task 9 — Installs draft control systems.

**Context** — Gasfitters install draft control systems to maintain safe and efficient operation of gas appliances. In this task, draft control systems include forced and induced draft control devices in the building as a system.

**Required Knowledge**

| | |
|---|---|
| K 1 | sizing calculations for draft control systems |
| K 2 | building as a system effects |
| K 3 | stack, chimney and draft effects |
| K 4 | types of natural draft control systems such as barometric dampers, draft hoods and draft dampers |
| K 5 | types of mechanical draft control systems such as induced and forced draft fans |
| K 6 | system components such as fans, blowers, motors, blades and controls |
| K 7 | fan and blower applications in combustion systems such as positive and non-positive displacements |
| K 8 | National Gas and Propane Installation Code (B149), applicable codes and AHJ |
| K 9 | manufacturers' specifications |

**Sub-task**

**C-9.01 Installs natural draft control systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| C-9.01.01 | select type of natural draft control systems such as barometric dampers, draft hoods and draft diverters according to manufacturers' specifications and job requirements |
| C-9.01.02 | select and use tools and equipment such as differential pressure gauges, manometers, draft gauges, and hand and power tools |
| C-9.01.03 | determine location of natural draft control system according to manufacturers' specifications |
| C-9.01.04 | select supporting material such as hangers, brackets and braces according to job requirements |

| | |
|---|---|
| C-9.01.05 | measure, identify and mark location of natural draft control system according to codes, manufacturers' specifications and job requirements |
| C-9.01.06 | mount, secure and adjust natural draft control system and draft dampers according to codes, manufacturers' specifications and job requirements |
| C-9.01.07 | connect and wire natural draft control systems to appliance according to manufacturers' specifications |

---

**Sub-task**

**C-9.02 Installs mechanical draft control systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| C-9.02.01 | select types of mechanical draft control systems such as induced and forced draft fans according to manufacturers' specifications and job requirements |
| C-9.02.02 | select and use tools and equipment such as differential pressure gauges, manometers, draft gauges, and hand and power tools |
| C-9.02.03 | determine location of mechanical draft control system according to manufacturers' specifications |
| C-9.02.04 | select supporting material such as hangers, brackets and braces according to job requirements |
| C-9.02.05 | measure, identify and mark location of mechanical draft control system according to codes, manufacturers' specifications and job requirements |
| C-9.02.06 | assemble mechanical draft control system components according to manufacturers' specifications |
| C-9.02.07 | mount and secure mechanical draft control system according to codes, manufacturers' specifications and job requirements |
| C-9.02.08 | connect and wire mechanical draft control systems to appliance according to manufacturers' specifications and codes |

## BLOCK D CONTROLS AND ELECTRICAL SYSTEMS

**Trends**

Computers and software have become more sophisticated and powerful in the amount of data they can store and process. There have been improvements in the simplicity and size of the human-machine interface (HMI). The capabilities and capacity of controllers are expanding. Communication platforms are becoming more seamlessly integrated and standardized. These rapid changes in technologies require continuous learning and upgrading of skills.

There is a decline in the use of pneumatic and mechanical systems and devices.

There is a trend towards green building certification such as LEED certification.

**Related Components (include, but not limited to)**

Dampers, actuators, gas valves, motors, cabling, wiring, fasteners, brackets, sensors, transmitters, external HMIs.

**Tools and Equipment**

See Appendix A.

### Task 10 Selects and installs electronic components.

**Context**

Gasfitters assemble, place, secure and connect combustion control systems, flame safeguards, and safety and operating controls for sectors such as residential and ICI.

The controls enable the systems to start, stop, monitor and modulate to obtain safe and energy efficient operation.

**Required Knowledge**

| | |
|---|---|
| K 1 | electricity principles such as Ohm's Law and Kirchhoff's Laws |
| K 2 | electrical symbols and wiring diagrams |
| K 3 | electrical systems such as low voltage, utility voltage, 3-phase and AC/DC |
| K 4 | electrical components such as relays, transformers, capacitors, power supplies and protective devices |

| | |
|---|---|
| K 5 | electrical motors, starters and related components such as variable frequency drives (VFDs), motor controls and DC motor controls |
| K 6 | CEC relevant to equipment |
| K 7 | electronic principles and components such as resistors and circuits |
| K 8 | code for the Field Approval of Fuel-related Components on Appliances and Equipment (B149.3) |
| K 9 | types of combustion control system components such as pressure transmitters, servo motors, control modules, fuel air ratio controls, and $O_2$, NOx and CO monitors |
| K 10 | procedures for installing combustion controls |
| K 11 | types of flame safeguards such as solid state and microprocessor |
| K 12 | applications and procedures for installing flame safeguards |
| K 13 | applications for types of flame detection such as ultraviolet (UV) and infrared (IR) scanners |
| K 14 | types of safety and operating control components such as on-off operators, low and high gas pressure switches, and combustion air proving switches |
| K 15 | procedures for installing safety and operating controls such as accommodating venting requirements |
| K 16 | operational sequence of digital and analog controls |
| K 17 | how to operate computer interfaces and use programs |
| K 18 | control point instrumentation such as resistance temperature detectors (RTD), pressure transducers, thermocouples and flow meters |
| K 19 | control signals such as 4 to 20 mA (milliamps) and 0-10 DC volts |
| K 20 | communication protocols such as Modbus and BACnet |
| K 21 | manufacturers' specifications |
| K 22 | programmable logic controllers (PLCs) |
| K 23 | jurisdictional regulations |
| K 24 | integrating different types of controls |
| K 25 | lock-out and tag-out procedures |
| K 26 | static discharge |
| K 27 | AHJ |

**Sub-task**

**D-10.01 Performs selection and installation of combustion controls.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| D-10.01.01 | verify original equipment specifications |
| D-10.01.02 | select and verify components considering factors such as site requirements, manufacturers 'specifications and type of equipment |
| D-10.01.03 | select and use tools and equipment such as drills, multimeters, signal generators, wire strippers, wiring identification equipment, and network cabling tools and testers |
| D-10.01.04 | select location and enclosures such as an existing or new panel considering factors such as manufacturers' specifications |
| D-10.01.05 | prepare location such as installing mounting points and brackets for components |
| D-10.01.06 | mount and connect combustion control and associated components such as $O_2$ monitors and HMI according to manufacturers' installation procedures |
| D-10.01.07 | program and configure control modules according to job design specifications such as emissions and efficiency |
| D-10.01.08 | verify, set up and confirm operation prior to commissioning |
| D-10.01.09 | update drawings to create as-built final drawings |

**Sub-task**

**D-10.02 Performs selection and installation of flame safeguards.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| D-10.02.01 | verify original equipment specifications |
| D-10.02.02 | select and verify components considering factors such as site requirements, manufacturers' specifications and type of equipment |
| D-10.02.03 | select and use tools and equipment such as drills, multimeters, signal generators, wiring identification equipment, and network cabling tools and testers |

| | |
|---|---|
| D-10.02.04 | select location and enclosures such as an existing or new panel and considering factors such as manufacturers' specifications |
| D-10.02.05 | prepare location such as installing mounting points and brackets for components |
| D-10.02.06 | mount and connect flame safeguards and associated components such as valve train devices according to manufacturers' installation procedures |
| D-10.02.07 | configure flame safeguard according to job design specification such as purge times and flame amplifiers |
| D-10.02.08 | verify, set up and confirm operation prior to commissioning |
| D-10.02.09 | update drawings to create as-built final drawings |

---

**Sub-task**

**D-10.03 Performs selection and installation of safety and operating controls.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| D-10.03.01 | verify original equipment specifications |
| D-10.03.02 | select and verify components considering factors such as site requirements, manufacturers' specifications and type of equipment |
| D-10.03.03 | select and use tools and equipment such as drills, multimeters, signal generators, wiring identification equipment, and network cabling tools and testers |
| D-10.03.04 | select location and enclosures such as an existing or new panel and considering factors such as manufacturers' specifications |
| D-10.03.05 | prepare location such as installing mounting points and brackets for components |
| D-10.03.06 | mount and connect safety and operating controls and associated components such as high limit controls, gas valves and pressure switches according to manufacturers' installation procedures |
| D-10.03.07 | configure safety and operating controls according to job design specification such as set points, high limits and minimum gas pressures |
| D-10.03.08 | verify, set up and confirm operation prior to commissioning |
| D-10.03.09 | update drawings to create as-built final drawings |

## Task 11 Selects and installs electrical components.

**Context**

Gasfitters assemble, place, secure and connect electrical components for sectors such as residential, commercial, industrial and institutional.

Electrical components enable system operation by providing power to sub-systems such as electronic controls, pumps and motors to obtain the designed condition and maintain safe operation.

**Required Knowledge**

| | |
|---|---|
| K 1 | electricity principles such as Ohm's Law and Kirchhoff's Laws |
| K 2 | electrical symbols and wiring diagrams |
| K 3 | electrical systems such as utility voltage and 3-phase |
| K 4 | electrical components such as pumps, solenoid valves, relays, transformers, capacitors, power supplies and protective devices |
| K 5 | AC/DC motors, starters and related components such as VFDs, motor controls, DC motor controls and electronically commutated motors (ECM) |
| K 6 | CEC relevant to equipment |
| K 7 | electronic principles and components such as capacitors and resistors |
| K 8 | operational sequence of digital and analog controls |
| K 9 | control signals such as 4 to 20 mA (milliamps) and 0-10 DC volts |
| K 10 | communication protocols such as Modbus and BACnet |
| K 11 | manufacturers' specifications |
| K 12 | jurisdictional regulations |
| K 13 | integrating different types of controls |
| K 14 | lock-out and tag-out procedures |
| K 15 | AHJ |

**Sub-task**

**D-11.01 Selects electrical components.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| D-11.01.01 | verify original equipment specifications such as voltage, amperage and revolutions per minute (RPM) |
| D-11.01.02 | select and verify components such as a transformers, relays (solid state relay (SSR) and electro mechanical relay) and motor starters considering factors such as site requirements, manufacturers' specifications and type of equipment |

**Sub-task**

**D-11.02 Performs assembly and connection of electrical components.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| D-11.02.01 | select and use tools and equipment such as drills, multimeters, signal generators and wire strippers |
| D-11.02.02 | select location and enclosures such as an existing or new panel considering factors such as manufacturers' specifications |
| D-11.02.03 | prepare location such as installing mounting points and brackets for components |
| D-11.02.04 | mount and connect electrical components according to manufacturers' installation procedures |
| D-11.02.05 | configure VFDs and ECMs according to job design specifications such as efficiency and performance |
| D-11.02.06 | verify, set up and confirm operation prior to commissioning |
| D-11.02.07 | update drawings to create as-built final drawings |

## Task 12 Installs automation and instrumentation control systems.

**Context**

Gasfitters assemble, place, secure and connect automation and instrumentation control systems in residential and ICI sectors. Automation control systems are used to control single units such as a boiler as well as multiple heating applications for buildings. Instrumentation control systems are used to control the flow of mediums such as liquid, steam and air.

Automation and instrumentation control systems provide monitoring, management, scheduling, load shedding, energy conservation, and enabling/disabling of equipment and processes to achieve efficiencies and precise parameter control.

**Required Knowledge**

| | |
|---|---|
| K 1 | electricity principles such as Ohm's Law and Kirchhoff's Laws |
| K 2 | electrical symbols and wiring diagrams |
| K 3 | CEC relevant to equipment |
| K 4 | electronic principles and components such as capacitors, diodes, triacs and resistors |
| K 5 | communication standards such as serial ports including RS-232 and RS-485, and communication speeds |
| K 6 | wireless devices and network cabling |
| K 7 | microprocessor and electronic controls |
| K 8 | procedures for installing automation and instrumentation control systems |
| K 9 | types of automation control systems that monitor energy consumption such as water, air, gases and electricity in buildings |
| K 10 | types of automation and instrumentation control system components such as controllers, peripheral devices and input/output devices |
| K 11 | types of instrumentation control systems such as boiler processor controllers that control pressure and flow |
| K 12 | control point instrumentation such as RTD, pressure transducers, thermistors and flow meters |
| K 13 | how to operate HMIs and use programs |
| K 14 | control signals such as 4 to 20 mA (milliamps) and 0-10 DC volts |
| K 15 | communication protocols such as Modbus, local operation network (LON) and BACnet |
| K 16 | operational sequence of digital and analog controls |
| K 17 | manufacturers' specifications |
| K 18 | PLCs |

| | |
|---|---|
| K 19 | jurisdictional regulations |
| K 20 | integrating different types of controls |
| K 21 | lock-out and tag-out procedures |
| K 22 | static discharge |
| K 23 | psychrometric characteristics and charts |
| K 24 | AHJ |

---

**Sub-task**

**D-12.01** **Performs selection of automation and instrumentation control systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| D-12.01.01 | verify original equipment specifications such as voltage and network protocols |
| D-12.01.02 | select components such as controllers, input and output devices, interface devices and final control elements |
| D-12.01.03 | select communication standards such as baud rates and network communication protocols |

---

**Sub-task**

**D-12.02** **Performs assembly and connection of automation and instrumentation control systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| D-12.02.01 | select and use tools and equipment such as hand tools, wiring identification equipment, and network cabling tools and testers |
| D-12.02.02 | select location and enclosures such as an existing or new panel considering factors such as manufacturers' specifications |
| D-12.02.03 | prepare location such as installing mounting points and brackets for components and cabling |

| | |
|---|---|
| D-12.02.04 | mount and connect automation and instrumentation control systems, and associated components such as power supplies and switching devices according to manufacturers' installation procedures |
| D-12.02.05 | program and configure controllers according to job design specifications such as control sequence requirements |
| D-12.02.06 | verify, set up and confirm operation prior to commissioning |
| D-12.02.07 | update drawings to create as-built final drawings |

## BLOCK E INSTALLATION OF SYSTEMS AND EQUIPMENT

**Trends**

The incorporation of advanced electronic devices in a range of appliances is increasing. LEED may restrict the use of some materials such as certain solvents and plastics. There is an increase in conversion from other energy sources to propane and natural gas.

**Related Components (include, but not limited to)**

**Pipes:** plastics, steels

**Fittings:** risers, tees, couplings, 90°, 45°, flanges, unions, flare nuts

**Fasteners:** rods, inserts, hangers, clamps, tie wires, zip ties, epoxies

**Tube and tubing:** copper, stainless, aluminum

Vaporizers, pumps, tanks, cylinders.

**Tools and Equipment**

See Appendix A.

### Task 13 Installs gas-fired system piping and equipment.

**Context**

Gasfitters install and connect gas-fired appliances to gas piping systems and energy distribution systems.

**Required Knowledge**

| | |
|---|---|
| K 1 | installation tools and equipment |
| K 2 | fittings such as flanges, couplings, unions and adapters |
| K 3 | lifting equipment |
| K 4 | gas-fired equipment such as gas burner systems, gas-fired appliances and regulators |
| K 5 | dual fuel burners |
| K 6 | principles and practices of electrical systems |
| K 7 | principles and practices of electrical controls and control systems |
| K 8 | QA and QC program |
| K 9 | types of pipe |
| K 10 | manufacturers' specifications |
| K 11 | National Gas and Propane Installation Code (B149), applicable codes and AHJ |

| | |
|---|---|
| K 12 | standards and regulations such as CSA, National Fire Protection Association (NFPA) and ANSI/ASME |
| K 13 | input gas pressures , flow rates and Btuh inputs |
| K 14 | metric and imperial systems of measurement and conversions |
| K 15 | component requirements for pilot and main valve trains |
| K 16 | methods of pipe tracing according to code and AHJ |
| K 17 | seismic considerations |

---

**Sub-task**

**E-13.01 Installs gas-fired equipment.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| E-13.01.01 | identify location for gas-fired equipment according to layout, site conditions and code requirements |
| E-13.01.02 | select tools and equipment such as dollies, lifting equipment and installation tools |
| E-13.01.03 | measure placement of gas-fired equipment according to layout, site conditions and code requirements |
| E-13.01.04 | installs hangers and supports according to codes and site conditions |
| E-13.01.05 | lift and move gas-fired equipment such as gas-fired appliances and regulators into place according to site conditions and codes |
| E-13.01.06 | secure and hang gas-fired equipment to support using fasteners such as rods, inserts and hangers according to drawings and manufacturers' specifications |
| E-13.01.07 | secure and square gas-fired equipment to housekeeping pads using fasteners such as bolts and inserts according to drawings and manufacturers' specifications |

**Sub-task**

**E-13.02 Installs gas piping systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| E-13.02.01 | identify location for piping according to layout, site conditions and code requirements |
| E-13.02.02 | select piping, supports, fittings and tracers according to codes, AHJ and site requirements |
| E-13.02.03 | select and use tools and equipment such as pipe wrenches and threaders according to installation requirements |
| E-13.02.04 | secure and hang piping to structure using fasteners such as rods, inserts and hangers according to drawings, codes, manufacturers' specifications and site conditions |
| E-13.02.05 | bury underground pipe according to drawings, manufacturers' specifications, codes, site conditions and AHJ |
| E-13.02.06 | install tracers along pipe according to manufacturers' specifications, AHJ and site requirements |
| E-13.02.07 | provide protection of piping according to codes, AHJ and site requirements |

**Sub-task**

**E-13.03 Connects gas supply to equipment.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| E-13.03.01 | select and use tools and equipment such as wrenches, tape measures, levels and plumb bobs |
| E-13.03.02 | select gas connectors such as quick-connects and flex connectors |
| E-13.03.03 | select joining compounds such as pipe dope and thread sealing tape according to manufacturers' specifications, codes and AHJ |
| E-13.03.04 | measure height and clearances of appliance connection according to codes and manufacturers' specifications |

| | |
|---|---|
| E-13.03.05 | install final connections to single fuel burner equipment according to codes and AHJ |
| E-13.03.06 | install final connections to dual fuel equipment according to codes and AHJ |

---

**Sub-task**

**E-13.04 Connects equipment to energy distribution systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| E-13.04.01 | select tools and equipment such as wrenches, tape measures, levels and plumb bobs |
| E-13.04.02 | select joining compounds such as pipe dope and thread sealing tape according to manufacturers' specifications, codes and AHJ |
| E-13.04.03 | level appliance distribution system connections according to manufacturers' specifications such as hydronic heating, steam, and $CO_2$ generators |
| E-13.04.04 | assemble final connection points using joining compounds according to manufacturers' specifications |

---

## Task 14 Installs gas-fired system components.

**Context** Gasfitters install valve trains and accessories to ensure safe operation and pressure control of gas-fired equipment.

**Required Knowledge**

| | |
|---|---|
| K 1 | installation tools and equipment |
| K 2 | fittings such as flanges, couplings, unions and adapters |
| K 3 | lifting equipment |
| K 4 | dual fuel burners |
| K 5 | gas-fired equipment such as gas burner systems, gas-fired appliances and regulators |
| K 6 | QA and QC program |
| K 7 | types of pipe |
| K 8 | principles and practices of electrical systems |
| K 9 | manufacturers' specifications |

| | |
|---|---|
| K 10 | National Gas and Propane Installation Code (B149.1), Code for the Field Approval of Fuel-Related Components on Appliances and Equipment (B149.3) and AHJ |
| K 11 | standards and regulations such as ANSI/ASME |
| K 12 | input gas pressures, flow rates and Btuh inputs |
| K 13 | valve train assemblies |
| K 14 | CEC |
| K 15 | operation and sequencing of controls |
| K 16 | common electrical symbols and wiring diagrams |
| K 17 | power supplies and protective devices |
| K 18 | motor control electrical circuits |
| K 19 | components such as VFDs, inverters, PLCs, mechanical and electrical controls, relays, switches and electrical motors |
| K 20 | fresh air supply, exhaust fans, dampers, interlock systems |
| K 21 | accessories such as pilot and main regulators, manual shut-off valves, liquid propane pumps, over-pressure reliefs, electronic air cleaners, vent lines, natural gas compressors and natural gas cylinders |

---

**Sub-task**

**E-14.01 Installs valve trains.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| E-14.01.01 | select required components according to code, manufacturers' specifications, AHJ and site requirements |
| E-14.01.02 | select and use tools and equipment such as wrenches, tape measures and vices |
| E-14.01.03 | select joining compounds such as pipe dope and thread sealing tape according to manufacturers' specifications, codes and AHJ |
| E-14.01.04 | select fasteners such as bolts, u-channel clips and riser clamps according to manufacturers' specifications, codes and AHJ |
| E-14.01.05 | installs hangers and supports according to codes and site conditions |
| E-14.01.06 | assemble valve train components according to manufacturers' specifications, codes and AHJ |

E-14.01.07 fasten supports to valve train to ensure valve train is supported according to manufacturers' specifications, codes and AHJ

E-14.01.08 assemble final connection points using joining compounds according to manufacturers' specifications

---

**Sub-task**

**E-14.02 Installs accessories.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

E-14.02.01 select accessories according to codes, manufacturers' specifications, AHJ and site requirements

E-14.02.02 select and use tools and equipment such as wrenches, tape measures and vices

E-14.02.03 select joining compounds such as pipe dope and thread sealing tape according to manufacturers' specifications, codes and AHJ

E-14.02.04 select fasteners such as bolts, u-channel clips, riser clamps according to manufacturers' specifications, codes and AHJ

E-14.02.05 fasten supports to accessories to ensure valve train is supported according to manufacturers' specifications, codes and AHJ

E-14.02.06 assemble final connection points according to manufacturers' specifications and codes

---

## Task 15 Installs propane storage and handling systems.

**Context** Gasfitters install propane storage tanks and cylinders, piping, safety devices and vaporizers for distribution and use.

**Required Knowledge**

K 1 installation tools and equipment

K 2 fittings such as flanges, couplings, unions and adapters

K 3 lifting equipment

K 4 sizing tanks and cylinders

K 5 gas vaporization systems

| | |
|---|---|
| K 6 | emergency response procedures |
| K 7 | PPE such as neoprene gloves and fire-rated clothing |
| K 8 | signage and identification labels |
| K 9 | schedules and types of pipe |
| K 10 | manufacturers' specifications |
| K 11 | Natural Gas and Propane Installation Code (B149.1), CEC, Propane Storage and Handling Code (B149.2), applicable codes and AHJ |
| K 12 | standards and regulations such as ANSI/ASME |
| K 13 | TDG |
| K 14 | input gas pressures, flow rates and Btuh inputs |
| K 15 | operation and sequencing of controls |
| K 16 | liquid withdrawal, flaring and evacuation procedures |
| K 17 | common electrical symbols and wiring diagrams |
| K 18 | explosion proof devices such as controls, motors, tools and switches |

---

**Sub-task**

**E-15.01 Installs propane storage systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | no | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| E-15.01.01 | select and confirm tanks and cylinders according to criteria such as storage capacity, Btuh load, design ambient temperature and certification |
| E-15.01.02 | determine and prepare installation location according to codes, AHJ and system requirements |
| E-15.01.03 | select and use tools and equipment such as picks, shovels, wrenches, tape measures, hand tools and rigging |
| E-15.01.04 | load, unload and relocate tanks and cylinders using equipment such as booms, cranes and power trucks according to codes and AHJ |
| E-15.01.05 | place vehicle protection barricades in designated space according to codes and AHJ |
| E-15.01.06 | place tanks and cylinders on level, solid, non-combustible base or buried underground according to manufacturers' specifications, codes and AHJ |
| E-15.01.07 | secure tanks and cylinders to base using fasteners according to manufacturers' specifications, codes and AHJ |

| | |
|---|---|
| E-15.01.08 | connect manifold and accessories such as tee blocks and excess flow valves to distribution system for vapour withdrawal according to manufacturers' specifications, codes and AHJ |
| E-15.01.09 | test lines and accessories for leaks using techniques such as high pressure test, soap and pressure gauges according to manufacturers' specifications, codes and AHJ |
| E-15.01.10 | connect liquid withdrawal to pipes, valves and vaporizers according to manufacturers' specifications, codes and AHJ |

---

**Sub-task**

**E-15.02 Installs propane handling systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | no | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| E-15.02.01 | identify and prepare location for propane handling systems according to layout, site conditions and code requirements |
| E-15.02.02 | select piping, supports, fittings, and vehicle protection barricades according to codes, AHJ and site requirements |
| E-15.02.03 | select tools and equipment such as wrenches, tape measures, hand tools and rigging |
| E-15.02.04 | assemble piping and components such as pumps, compressors, excess flow valves and metering systems |
| E-15.02.05 | perform pressure test on piping lines according to manufacturers' specifications, codes and AHJ |

# BLOCK F TESTING AND COMMISSIONING OF GAS-FIRED SYSTEMS

**Trends**

There are new technologies, materials and components used in gas-fired systems. Gasfitters must be aware of these advances in technology in order to perform testing and commissioning of these systems.

There is an increase in documentation requirements from engineers, inspectors and owners. This is due to an increase in energy efficiency, accountability, safety and environmental requirements.

**Related Components**

All components apply.

**Tools and Equipment**

See Appendix A.

## Task 16 Tests gas-fired systems.

**Context**

Gasfitters test complete gas-fired systems to ensure safety and efficiency. Testing of the system is done after installation to verify that the system meets the design parameters and criteria prior to commissioning the system.

**Required Knowledge**

| | |
|---|---|
| K 1 | jurisdictional testing requirements such as witness sign-off, reporting and engineers' inspection, and AHJ inspection |
| K 2 | QA and QC requirements |
| K 3 | codes such as National Gas and Propane Installation Code (B149.1), CEC and NBC |
| K 4 | testing procedures specified in National Gas and Propane Installation Code (B149.1) such as time and test pressure requirements |
| K 5 | purging and flaring sequence and procedures |
| K 6 | testing equipment such as manometers, electronic testers and multimeters |
| K 7 | schematic wiring diagrams for interpretations of sequence of operation |

| | |
|---|---|
| K 8 | gas pressures supplied by utility and required by manufacturers' specifications |
| K 9 | venting and air supply requirements according to National Gas and Propane Installation Code (B149.1) |
| K 10 | building characteristics and conditions |
| K 11 | manufacturers' specifications |

---

**Sub-task**

**F-16.01 Tests gas piping systems.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| F-16.01.01 | isolate system such as gas meter and pressure sensitive equipment for testing according to National Gas and Propane Installation Code (B149.1) |
| F-16.01.02 | install testing equipment such as gauges and valves according to National Gas and Propane Installation Code (B149.1) |
| F-16.01.03 | perform system pressurization testing using a medium such as air, nitrogen or $CO_2$ |
| F-16.01.04 | record and compare test results to National Gas and Propane Installation Code (B149.1) requirements, manufacturers' specifications and AHJ |
| F-16.01.05 | perform flaring off and purging procedures for safe gasification of piping |
| F-16.01.06 | reconnect after testing, and paint and identify (label) piping according to National Gas and Propane Installation Code (B149.1) specifications |
| F-16.01.07 | perform leak test using methods such as approved leak testing solution and electronic combustible gas leak detector |

**Sub-task**

**F-16.02 Performs start-up procedures.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| F-16.02.01 | purge system for start-up according to National Gas and Propane Installation Code (B149) procedures to ensure stable gas supply to appliance |
| F-16.02.02 | perform installation checks such as valve train components, linkages, safeties, type of gas and electrical inputs |
| F-16.02.03 | reconnect gas line to appliance |
| F-16.02.04 | check lines and fittings for leaks using methods such as soap test, lockup test, and electronic test according to National Gas and Propane Installation Code (B149) |
| F-16.02.05 | verify gas supply and pressure using measuring tools such as manometers and electronic testers |
| F-16.02.06 | check electrical configurations to ensure voltage and amperage are set to appliance manufacturers' requirements |
| F-16.02.07 | perform rotation check of motors |
| F-16.02.08 | perform series of dry runs to test electrical, electronic and control operation |
| F-16.02.09 | perform flame detection test to confirm strength of flame signal |
| F-16.02.10 | perform pilot turndown test to confirm smooth lighting of burners |
| F-16.02.11 | follow manufacturers' and AHJ start-up procedures such as setting controls and adjustments and air/gas ratio |
| F-16.02.12 | confirm operation of safety and operating controls |

## Task 17 Commissions gas-fired systems.

**Context** Gasfitters verify the operation of the entire system after installation to ensure that it attains optimum performance. Providing documentation and explanation to the end user is also a key responsibility when commissioning a system.

**Required Knowledge**

| | |
|---|---|
| K 1 | types and operation of gas-fired systems such as hydronic, steam, domestic hot water, hot air system, humidification, kitchen and process equipment |
| K 2 | electrical, electronic and control system |
| K 3 | tools and testing equipment used for commissioning such as manometers, combustion analyzers and multimeters |
| K 4 | safety controls such as low water cut-off, high and low limits and switches |
| K 5 | start-up procedures specified by National Gas and Propane Installation Code (B149.1), manufacturers and AHJ |
| K 6 | system accessories such as pumps, coils, humidifiers, valves and actuators |
| K 7 | documentation requirements for commissioning as required by manufacturers' and engineering specifications |
| K 8 | testing procedures such as bubble test for valve closure and vent valve test |
| K 9 | final settings and adjustments for equipment |
| K 10 | firing rate valve procedures |
| K 11 | calculations such as pre and post purge times based on volumes and number of air changes |
| K 12 | manufacturers' specifications |
| K 13 | combustion system and allowable products of combustion |

**Sub-task**

**F-17.01 Performs testing, adjusting and balancing procedures.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| F-17.01.01 | select and use diagnostic tools such as manometers, multimeters and combustion analyzers |
| F-17.01.02 | introduce gas and adjust components such as gas valves and air dampers to achieve mixtures required for complete and efficient combustion and according to manufacturers' specifications by interpreting readings obtained from diagnostic tools |
| F-17.01.03 | check conditions such as water quality and flow rates to match system requirements |
| F-17.01.04 | check temperature rise through heat exchanger and flow velocities to match system requirements |
| F-17.01.05 | evaluate equipment performance using equipment such as combustion test analysers and thermometers to verify air gas mix, combustion air volume, CO and $CO_2$ levels, and stack temperature |
| F-17.01.06 | perform system start-up procedures such as boilouts in hot water and steam systems, and refractory and equipment curing |
| F-17.01.07 | measure pressure drop across balancing valves and adjust flow to within system parameters |
| F-17.01.08 | adjust and calibrate controls to meet manufacturers' specifications and system demands |
| F-17.01.09 | perform operational and safety checks such as clocking meter and checking high limits |
| F-17.01.10 | verify operation of gas-fired systems by operating equipment through several cycles to ensure equipment meets manufacturers' specifications |
| F-17.01.11 | check external static pressure (ESP) to match system requirements |

**Sub-task**

**F-17.02 Completes commissioning report and handover.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| F-17.02.01 | record testing results such as voltages, gas pressures and efficiencies, and compare to manufacturers' baseline information |
| F-17.02.02 | prepare documentation required by job site and manufacturers' specifications |
| F-17.02.03 | explain system operational procedures and specifications to end user |

## BLOCK G — SERVICING GAS-FIRED SYSTEMS

**Trends**

New materials and components used in gas-fired systems impact the servicing processes. These include plastic piping, electronic controls and high efficiency appliances. Often, maintenance of these systems includes inspection of installation, repairs and upgrading/retrofitting materials and components.

Decommissioning work and disposal of equipment and components has been impacted by more stringent environmental and recycling regulations and procedures.

**Related Components**

All components apply.

**Tools and Equipment**

See Appendix A.

### Task 18 — Maintains gas-fired systems.

**Context**

Maintaining gas-fired appliances and systems is important to ensure optimal efficiency, reliable service and safe operation of the system.

**Required Knowledge**

| | |
|---|---|
| K 1 | sequence of operation |
| K 2 | function and operation of tools such as manometers, draft gauges, electric meters and combustion analyzers |
| K 3 | thermodynamic concepts such as heat transfer and temperature rise |
| K 4 | electrical concepts such as schematics, amperage, wattage and voltage |
| K 5 | control system components and operation |
| K 6 | theory of combustion |
| K 7 | lower and higher explosive limits for various fuels |
| K 8 | types of oils and lubricants |
| K 9 | manufacturers' specifications such as requirements for venting, gas pressures, and temperature and pressure differences |
| K 10 | code requirements such as de-pressurization of building and draft requirements for appliance |

| | |
|---|---|
| K 11 | burners and appliance disassembly and assembly procedures |
| K 12 | indoor air quality requirements and building as a system |
| K 13 | water quality and treatment |
| K 14 | documentation such as maintenance reports, check sheets and permits |
| K 15 | AHJ |

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**Sub-task**

**G-18.01 Inspects system components and operation.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-18.01.01 | verify that installation conforms to code requirements and AHJ |
| G-18.01.02 | inspect fuel delivery system components such as gas lines for operation |
| G-18.01.03 | check operator controls to verify operation to manufacturers' specifications |
| G-18.01.04 | inspect heat emitters such as radiators and ducts |
| G-18.01.05 | inspect venting, chimneys and air supply to ensure operation according to code |
| G-18.01.06 | inspect refractory components of combustion chamber and heat exchangers for cracks and deterioration |
| G-18.01.07 | inspect mechanical components such as switches, valves, dampers, fans, motors and air differential proving switches |
| G-18.01.08 | measure air velocity to identify system conditions such as blocked screens and dampers |
| G-18.01.09 | measure combustion chamber pressure to ensure that it is set at manufacturer-specified levels to ensure complete combustion |
| G-18.01.10 | check operation of safety components such as flame rod, UV and infrared scanner by performing sensory inspection |
| G-18.01.11 | check and measure spark electrode and gaps to ensure that it is set to manufacturers' specifications |
| G-18.01.12 | test safety limits such as high limit, high and low water cut-offs, flow switches and high and low gas pressure switches to verify operation |
| G-18.01.13 | measure and record inlet and outlet pressures to ensure they are within manufacturers' specifications and code |
| G-18.01.14 | perform flame detection tests such as scanner check, flame signal test and ignition spark response test |
| G-18.01.15 | perform pilot turndown test to confirm smooth lighting of burners |

| | |
|---|---|
| G-18.01.16 | inspect burner performance using a combustion test analyser to verify air gas mix, combustion air volume, CO levels and stack temperature |
| G-18.01.17 | verify condensate lines are clean and clear of debris |
| G-18.01.18 | inspect gas valves to ensure complete closure |
| G-18.01.19 | check for leaks using electronic leak detectors and sensory inspection |

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**Sub-task**

**G-18.02 Performs maintenance activities.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-18.02.01 | replace components such as belts, flame rods, filters and gaskets according to maintenance schedule |
| G-18.02.02 | clean system components such as combustion chambers, burners, flame rods and scanners |
| G-18.02.03 | lubricate components according to manufacturers' specifications to ensure smooth operation of system |
| G-18.02.04 | remove components such as burners using hoisting equipment |
| G-18.02.05 | adjust burner to ensure combustion is according to manufacturers' specifications and required operation |
| G-18.02.06 | document repairs required for predictive component replacement |

---

## Task 19 Repairs gas-fired systems.

**Context**

Gasfitters repair gas-fired systems by diagnosing problems and isolating problem areas. They replace faulty components to correct the issue. It is important to subsequently verify the operation of the repaired system and fully document the repair work.

**Required Knowledge**

| | |
|---|---|
| K 1 | sequence of operation to assist with troubleshooting |
| K 2 | operation of gas-fired system to be repaired |
| K 3 | function and operation of diagnostic and repair tools such as manometers, draft gauges, multimeters and combustion analyzers |

| | |
|---|---|
| K 4 | thermodynamic concepts such as heat transfer and temperature rise |
| K 5 | electrical concepts such as schematics, amperage, wattage and voltage |
| K 6 | control system components and operation |
| K 7 | theory of combustion |
| K 8 | lower and higher explosive limits for various fuels |
| K 9 | types of oils and lubricants |
| K 10 | manufacturers' specifications such as requirements for venting, gas pressures, and temperature and pressure differences |
| K 11 | code requirements such as de-pressurization of building and draft requirements for appliance |
| K 12 | burners and appliance disassembly and assembly procedures |
| K 13 | diagnostic and troubleshooting procedures |
| K 14 | documentation such as service reports, check sheets and permits |
| K 15 | AHJ |

---

**Sub-task**

**G-19.01 Diagnoses gas-fired equipment and components.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-19.01.01 | monitor equipment performance to identify faults or erratic operation |
| G-19.01.02 | select and use diagnostic tools such as manometers, draft gauges, combustion analyzers, multimeters and ammeters |
| G-19.01.03 | apply troubleshooting techniques to isolate problems |
| G-19.01.04 | check flame signal using testing device to identify operation of flame safeguards |
| G-19.01.05 | check operation of electrical components such as fuses, transformers, contacts, relays, limit switches and control devices |
| G-19.01.06 | check and verify gas pressures to ensure switches meet operational parameters |
| G-19.01.07 | inspect burner performance using combustion test analyzer to verify air gas mix, combustion air volume, CO levels and stack temperature |
| G-19.01.08 | set up diagnostic monitoring devices to record and identify operating conditions and interpret fault codes |

**Sub-task**

**G-19.02 Selects replacement components.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | Yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-19.02.01 | identify equipment by make, model number, serial number and manufacturers' code |
| G-19.02.02 | source out parts, availability of equipment and compatibility of replacement parts |
| G-19.02.03 | verify replacement parts are all included and operate according to specifications |
| G-19.02.04 | verify temperature and pressure ratings of replacement devices |
| G-19.02.05 | ensure that component is approved for the fuel being used |

**Sub-task**

**G-19.03 Replaces components.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-19.03.01 | lock-out and tag-out system by isolating energy sources |
| G-19.03.02 | remove and reassemble protective covers, shields and other components to access repair area |
| G-19.03.03 | disconnect and reconnect wiring and linkages as necessary |
| G-19.03.04 | record configuration of components using sketches, photographs and markings in order to facilitate re-assembly |
| G-19.03.05 | remove defective components and install replacement components using hand and power tools |
| G-19.03.06 | dispose of and recycle faulty components according to AHJ |

**Sub-task**

**G-19.04 Verifies operation.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-19.04.01 | remove lock-out and tag-out and restore energy sources |
| G-19.04.02 | select and use testing tools such as manometers, draft gauges, combustion analyzers, multimeters and ammeters |
| G-19.04.03 | ensure operation meets conditions specified by manufacturer |
| G-19.04.04 | perform tests such as combustion analysis, high and low limit tests, and low water cut-off checks |
| G-19.04.05 | ensure electrical components such as motors have the correct rotation and are at the rated operating parameters |
| G-19.04.06 | verify operation of replacement components such as valves, regulators and switches |
| G-19.04.07 | confirm smooth lighting and operation of burner |
| G-19.04.08 | operate system through several cycles and monitor performance throughout |
| G-19.04.09 | complete documentation such as service reports, check sheets and permits |

## Task 20 Decommissions gas-fired systems.

**Context** Gasfitters decommission systems for upgrading, retrofitting or demolition. Safety and isolation of energy sources is very important.

**Required Knowledge**

| | |
|---|---|
| K 1 | lock-out and tag-out requirements |
| K 2 | types of gas-fired appliances such as boilers, furnaces, rooftop units and water heaters |
| K 3 | appliance components such as valves, dampers, modulating motors and coils |
| K 4 | accessories such as heating and cooling coils, humidifiers, electronic air cleaners, filtration systems and pumps |

| | |
|---|---|
| K 5 | limitations and licensing requirements for disconnecting appliances and accessories |
| K 6 | disposal regulations for hazardous materials |
| K 7 | complete building system and the effect removal can have on remaining gas equipment and accessories |
| K 8 | AHJ |

---

**Sub-task**

**G-20.01 Disconnects appliances and accessories.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-20.01.01 | select and use hand and power tools such as saws, drills and hammers |
| G-20.01.02 | rig and hoist heavy equipment and components for removal |
| G-20.01.03 | perform lock-out and tag-out procedures for all energy sources |
| G-20.01.04 | disconnect and terminate control wires and tubing |
| G-20.01.05 | isolate, purge and cap gas supply according to gas code requirements |
| G-20.01.06 | isolate and terminate electrical supply according to CEC requirements |
| G-20.01.07 | remove and cap venting system |
| G-20.01.08 | remove and cap distribution system such as piping and ductwork |
| G-20.01.09 | isolate accessory from system and remove energy source to disable function |
| G-20.01.10 | remove accessory from appliance |
| G-20.01.11 | check for leaks to ensure that systems are safe according to codes and safe work practices |

**Sub-task**

**G-20.02 Removes gas-fired systems and components.**

| NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NV | yes | yes | yes | yes | ND | yes | ND | yes | yes | NV | NV | ND |

**Key Competencies**

| | |
|---|---|
| G-20.02.01 | select and use specialized tools and rigging equipment for removal of equipment |
| G-20.02.02 | coordinate with personnel such as a designate, other trades and contractors as required for moving equipment |
| G-20.02.03 | store equipment according to jobsite conditions and regulations |
| G-20.02.04 | dispose of and recycle selected materials according to environmental acts, regulations and best practices |

# APPENDICES

# APPENDIX A TOOLS AND EQUIPMENT

### Safety Gear and Personal Protective Equipment (PPE)

air quality monitor
apron
arc flash protection
barricade/guardrails/pylons
eye wash kit
face shield
fall-arrest and restraint systems
fire blanket
fire extinguishers
first aid kit
gloves (industrial rubber [low/high voltage] and leather)
hard hat
hearing protection (plugs, muffs)
high-visibility clothing
leather chaps
lock-out devices and padlock
masks (dust, particle and filter)
overalls (fire-rated)
rain suit
respirator
respirator cartridge
respiratory mask
rubber boots
safety boots
safety glasses/goggles
self-contained breathing apparatus (SCBA)
warning signs and caution tape
welder visors
welding screens

### Hand tools

adjustable wrench
angle finder
bearing puller
bolt cutters
bolt die
bolt tap
broom
brush (wire, paint, acid and fitting)
callipers
caulking gun
C-clamp
centre-point set
chalk line
chisels
cloth (sand, emery, sandpaper)
cold-chisel set
combination wire strippers
combination wrench set (imperial and metric)
conduit benders
crimpers
crowbar
differential pressure gauge
dolly
draft gauge
drift-punch set
extendable mirror
feeler gauges
files
fish tape
flange alignment pins
flange spreader (jacks)
flaring tools
flashlight
folding rule
fuse pullers
gas cylinders, and soldering and brazing equipment

**Hand tools (continued)**

gas leak detector solution
gasket cutter
grease gun
hacksaw
hammers (claw, ball peen, sledge, brass, chipping, soft-face)
hand crimper
hand drill
hand saw
hex/torx keys (set)
hole saw
ignition tools (sparker, torch)
keyhole saw
knife
knockout (k.o.) set
labelling machine
level (line, laser and transit)
nut driver set
oiling can
orifice drills
pencil and pad
PEX pipe expander (manual)
pick
pipe cutters (single-wheel, multi-wheel)
pipe stands (roller and V type)
pipe tap
pipe threader
pipe vises (chain and yokes, tri-stand and bench vise)
pipe wraparound
pipe wrenches
pitot tube (velometer)
plastic pipe cutter
pliers (linesmen's, needle-nose, side cutters, snap-ring, locking, slip joint)
plumb bob
power cart
pry bar
pullers
punch
purging equipment
rasps
ratchet

reamer
scratch awl
screw extractors
screwdrivers (complete set)
shovel
socket sets (imperial and metric)
spacing tool
spud wrench
square
striker
swaging tool
swedge (hand flaring tool)
T square
tap and die set
tape measures
threading hand dies
tin snips
tip cleaner

toolbox
torches
torque wrench
transfer pump (hand-operated)

tri-square
tube bender
tube cleaner
tube cutter
utility brush

wire strippers
wood chisels

### Power Tools

air compressor and accessories
air tools
arc welders (electrical, fuel)
band saw
blowers
chop-saw
circular saw
compressed gas cylinders (purge, shield, cutting)
cordless tools (drills, saws)
crimping tools
electric drill
exhaust fans
grinders (electric or pneumatic, angle, bench, die, pedestal)
hammer-drill
heat gun
impact driver
impact gun
impact wrench
jigsaw
knockout cutters
lighting equipment
nibbler
PEX pipe expander (power)
portable band saw (hacksaw)
powder-actuated tools
power pipe threader
power threading machine
propane tiger torches (preheating)
reciprocating saw
rotary hammer
soldering guns
tank lifter
transfer pump
vacuum cleaners (HEPA)
welding equipment (MIG, TIG)

### Hoisting, Rigging and Access Tools and Equipment

eye bolts
ladders (combination, extension, step)
lifts (electrical, hydraulic, pneumatic, hand and power winch, one-person, platform, scissor lift, articulating boom)
portable wire rope winch
rigging tools (blocks, come-alongs, snatch block, handlines and pulleys)
rope/cable
scaffolding
shackles (varying sizes)
slings and chokers
wire rope or nylon (synthetic)

### Technical Instruments and Testers

atmosphere tester
calculators
capacitor tester
manometer
manufacturer-specific diagnostic equipment
megohmmeter

clamp-on ammeter
combustion analyzer

computers
data recorders
differential pressure gauge and sight tube
digital recording
digital tachometer

draft gauge
drafting equipment
electronic leak detector
ground resistance tester

hand pump and accessories
hydrostatic pump and gauge (manual and power)

micrometer
multimeter (voltage, amperage, resistance)
ohmmeter
rotameter
rulers

scale ruler
squares (standard 24 in. combination, flange, straightedge)
string line
temperature tester
thermocouple tester
thermometer (infrared, electronic, mechanical)
true RMS meters
velocity meter

# APPENDIX B GLOSSARY

| | |
|---|---|
| **building as a system** | building is made up of components that work together to form an integrated system. |
| **forced draft** | burner that uses fans to supply air for combustion, pressurizing the inlet to a heat exchanger |
| **induced daft** | burner that induces air into the combustion chamber by applying a negative pressure at the out let of the heat exchanger. |
| **spool sheet** | Pipe fabrication details |

# APPENDIX C ACRONYMS

| | |
|---|---|
| **AHJ** | authority having jurisdiction |
| **ANSI** | American National Standards Institute |
| **ASME** | American Society of Mechanical Engineers |
| **Btuh** | British thermal units per hour |
| **CEC** | Canadian Electrical Code |
| **CPVC** | chlorinated polyvinyl chloride |
| **CSA** | Canadian Standards Association |
| **CSST** | Corrugated Stainless Steel Tubing |
| **ECM** | electronically commutated motors |
| **ESP** | external static pressure |
| **HMI** | human-machine interface |
| **ICI** | industrial, commercial and institutional |
| **IR** | infrared |
| **kW** | kilowatts |
| **LEED** | Leadership in Energy and Environmental Design |
| **LON** | local operation network |
| **mA** | milliamps |
| **MSDS** | material safety data sheet |
| **NBC** | National Building Code |
| **NEMA** | National Electrical Manufacturers Association |
| **OH&S** | Occupational Health and Safety |
| **PLC** | programmable logic controller |
| **PPE** | Personal Protective Equipment |

| | |
|---|---|
| **PVC** | polypropylene, polyvinyl chloride |
| **QA** | Quality assurance |
| **QC** | Quality control |
| **RPM** | revolutions per minute |
| **RTD** | resistance temperature detector |
| **TDG** | Transport of Dangerous Goods |
| **ULC** | Underwriters Laboratories of Canada |
| **UV** | ultraviolet |
| **VFD** | variable frequency drive |
| **WHMIS** | Workplace Hazardous Materials Information System |

# APPENDIX D — BLOCK AND TASK WEIGHTING

## BLOCK A COMMON OCCUPATIONAL SKILLS

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | National Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 8 | 10 | 4 | 5 | ND | 5 | ND | 5 | 5 | NV | NV | ND | 6% |

Task 1 Performs safety-related functions.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 36 | 40 | 18 | 25 | ND | 20 | ND | 15 | 0 | NV | NV | ND | 22% |

Task 2 Maintains and uses tools and equipment.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 31 | 30 | 36 | 30 | ND | 20 | ND | 25 | 10 | NV | NV | ND | 26% |

Task 3 Plans and prepares for installation, service and maintenance.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 33 | 30 | 46 | 45 | ND | 60 | ND | 60 | 90 | NV | NV | ND | 52% |

## BLOCK B GAS PIPING PREPARATION AND ASSEMBLY

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | National Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 11 | 5 | 8 | 15 | ND | 15 | ND | 5 | 7 | NV | NV | ND | 10% |

Task 4 Fits tube and tubing for gas piping systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 16 | 30 | 29 | 40 | ND | 20 | ND | 30 | 30 | NV | NV | ND | 28% |

Task 5 Fits plastic pipe for gas piping systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 31 | 35 | 27 | 10 | ND | 20 | ND | 30 | 10 | NV | NV | ND | 23% |

Task 6 Fits steel pipe for gas piping systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 53 | 35 | 44 | 50 | ND | 60 | ND | 40 | 60 | NV | NV | ND | 49% |

**BLOCK C VENTING AND AIR SUPPLY SYSTEMS**

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | National Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 12 | 10 | 14 | 5 | ND | 10 | ND | 15 | 10 | NV | NV | ND | 11% |

Task 7 Installs venting.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 40 | 40 | 42 | 60 | ND | 50 | ND | 35 | 40 | NV | NV | ND | 44% |

Task 8 Installs air supply system.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 40 | 40 | 31 | 30 | ND | 30 | ND | 35 | 20 | NV | NV | ND | 32% |

Task 9 Installs draft control systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 20 | 20 | 27 | 10 | ND | 20 | ND | 30 | 40 | NV | NV | ND | 24% |

**BLOCK D CONTROLS AND ELECTRICAL SYSTEMS**

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | National Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 19 | 25 | 22 | 5 | ND | 25 | ND | 20 | 25 | NV | NV | ND | 20% |

Task 10 Selects and installs electronic components.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 36 | 30 | 36 | 30 | ND | 35 | ND | 35 | 40 | NV | NV | ND | 35% |

Task 11 Selects and installs electrical components.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 36 | 30 | 33 | 40 | ND | 35 | ND | 35 | 30 | NV | NV | ND | 34% |

Task 12 Installs automation and instrumentation control systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 28 | 40 | 31 | 30 | ND | 30 | ND | 30 | 30 | NV | NV | ND | 31% |

**BLOCK E INSTALLATION OF SYSTEMS AND EQUIPMENT**

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | National Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 14 | 20 | 16 | 30 | ND | 20 | ND | 20 | 20 | NV | NV | ND | 20% |

Task 13 Installs gas-fired system piping and equipment.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 39 | 30 | 34 | 65 | ND | 40 | ND | 35 | 45 | NV | NV | ND | 41% |

Task 14 Installs gas-fired system components.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 41 | 30 | 34 | 35 | ND | 40 | ND | 45 | 45 | NV | NV | ND | 39% |

Task 15 Installs propane storage and handling systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 20 | 40 | 32 | 0 | ND | 20 | ND | 20 | 10 | NV | NV | ND | 20% |

**BLOCK F TESTING AND COMMISSIONING OF GAS-FIRED SYSTEMS**

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | National Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 18 | 15 | 20 | 10 | ND | 10 | ND | 20 | 15 | NV | NV | ND | 15% |

Task 16 Tests gas-fired systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 54 | 50 | 52 | 40 | ND | 50 | ND | 60 | 50 | NV | NV | ND | 51% |

Task 17 Commissions gas-fired systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 46 | 50 | 48 | 60 | ND | 50 | ND | 40 | 50 | NV | NV | ND | 49% |

**BLOCK G SERVICING GAS-FIRED SYSTEMS**

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | National Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 18 | 15 | 16 | 30 | ND | 15 | ND | 15 | 18 | NV | NV | ND | 18% |

Task 18 Maintains gas-fired systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 30 | 40 | 38 | 40 | ND | 40 | ND | 40 | 30 | NV | NV | ND | 37% |

Task 19 Repairs gas-fired systems.

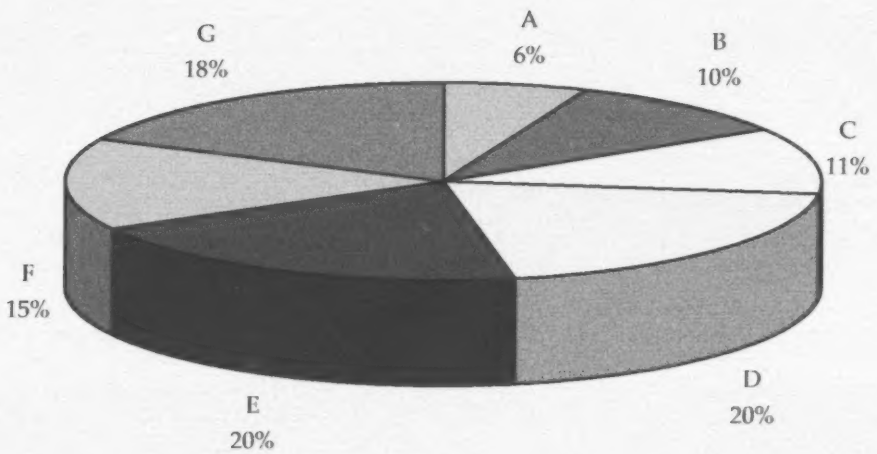
| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 50 | 40 | 44 | 50 | ND | 40 | ND | 40 | 60 | NV | NV | ND | 46% |

Task 20 Decommissions gas-fired systems.

| | NL | NS | PE | NB | QC | ON | MB | SK | AB | BC | NT | YT | NU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % | NV | 20 | 20 | 18 | 10 | ND | 20 | ND | 20 | 10 | NV | NV | ND | 17% |

## APPENDIX E

## PIE CHART*




**TITLES OF BLOCKS**

| | | | |
|---|---|---|---|
| BLOCK A | Common Occupational Skills | BLOCK E | Installation of systems and equipment |
| BLOCK B | Gas piping preparation and assembly | BLOCK F | Testing and commissioning of gas-fired systems |
| BLOCK C | Venting and air supply systems | BLOCK G | Servicing gas-fired systems |
| BLOCK D | Controls and electrical systems | | |

*Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

# APPENDIX F

## TASK PROFILE CHART — GASFITTER-CLASS A

| BLOCKS | TASKS | SUB-TASKS | | | |
|---|---|---|---|---|---|
| A – COMMON OCCUPATIONAL SKILLS | 1. Performs safety-related functions. | 1.01 Uses personal protective equipment (PPE) and safety equipment. | 1.02 Maintains safe work environment. | | |
| | 2. Maintains and uses tools and equipment. | 2.01 Maintains hand, power and powder-actuated tools. | 2.02 Uses technical instruments and testers. | 2.03 Uses access equipment. | 2.04 Operates lifting, rigging and hoisting equipment. |
| | 3. Plans and prepares for installation, service and maintenance. | 3.01 Interprets drawings and codes. | 3.02 Selects systems, equipment and components. | 3.03 Organizes work. | |
| B - GAS PIPING PREPARATION AND ASSEMBLY | 4. Fits tube and tubing for gas piping systems. | 4.01 Prepares tube and tubing for fitting. | 4.02 Bends tube and tubing for gas piping systems. | 4.03 Connects tube and tubing for gas piping systems. | |
| | 5. Fits plastic pipe for gas piping systems. | 5.01 Prepares plastic pipe for fitting. | 5.02 Connects plastic pipe for gas piping systems. | | |
| | 6. Fits steel pipe for gas piping systems. | 6.01 Prepares steel pipe for fitting. | 6.02 Connects steel pipe for gas piping systems. | | |
| C - VENTING AND AIR SUPPLY SYSTEMS | 7. Installs venting. | 7.01 Lays out venting. | 7.02 Prepares venting material for assembly. | 7.03 Connects material for venting. | |

| BLOCKS | TASKS | SUB-TASKS | | | |
|---|---|---|---|---|---|
| | 8. Installs air supply system. | 8.01 Lays out air supply system. | 8.02 Connects air supply systems. | | |
| | 9. Installs draft control systems. | 9.01 Installs natural draft control systems. | 9.02 Installs mechanical draft control systems. | | |
| D - CONTROLS AND ELECTRICAL SYSTEMS | 10. Selects and installs electronic components. | 10.01 Performs selection and installation of combustion controls. | 10.02 Performs selection and installation of flame safeguards. | 10.03 Performs selection and installation of safety and operating controls. | |
| | 11. Selects and installs electrical components. | 11.01 Selects electrical components. | 11.02 Performs assembly and connection of electrical components. | | |
| | 12. Installs automation and instrumentation control systems. | 12.01 Performs selection of automation and instrumentation control systems. | 12.02 Performs assembly and connection of automation and instrumentation control systems. | | |
| E - INSTALLATION OF SYSTEMS AND EQUIPMENT | 13. Installs gas-fired system piping and equipment. | 13.01 Installs gas-fired equipment. | 13.02 Installs gas piping systems. | 13.03 Connects gas supply to equipment. | 13.04 Connects equipment to energy distribution systems. |
| | 14. Installs gas-fired system components. | 14.01 Installs valve trains. | 14.02 Installs accessories. | | |
| | 15. Installs propane storage and handling systems. | 15.01 Installs propane storage systems. | 15.02 Installs propane handling systems. | | |

| BLOCKS | TASKS | SUB-TASKS | | | |
|---|---|---|---|---|---|
| F - TESTING AND COMMISSIONING OF GAS-FIRED SYSTEMS | 16. Tests gas-fired systems. | 16.01 Tests gas piping systems. | 16.02 Performs start-up procedures. | | |
| | 17. Commissions gas-fired systems. | 17.01 Performs testing, adjusting and balancing procedures. | 17.02 Completes commissioning report and handover. | | |
| G - SERVICING GAS-FIRED SYSTEMS | 18. Maintains gas-fired systems. | 18.01 Inspects system components and operation. | 18.02 Performs maintenance activities. | | |
| | 19. Repairs gas-fired systems. | 19.01 Diagnoses gas-fired equipment and components. | 19.02 Selects replacement components. | 19.03 Replaces components. | 19.04 Verifies operation. |
| | 20. Decommissions gas-fired systems. | 20.01 Disconnects appliances and accessories. | 20.02 Removes gas-fired systems and components. | | |